

## CLAIMS

I claim:

1. An electrochemical cell, comprising:
  - a) a container housing a first electrode, said electrode defining a cavity therein;
  - b) a separator lining said cavity and abutting said first electrode;
  - 5 c) a second electrode disposed within said separator lined cavity, said second electrode having a known volume and less than 50 ppm of mercury, said second electrode comprises zinc powder having a tap density greater than 2.80 g/cc and less than 3.65 g/cc, said zinc powder occupies less than 28.0 volume percent of said second electrode's volume; and
  - 10 d) a quantity of alkaline electrolyte disposed within said container and in contact with said electrodes and said separator.
2. The electrochemical cell of claim 1, wherein the volume of zinc is no greater than 27.0% of the second electrode's volume.
3. The electrochemical cell of claim 1, wherein the volume of zinc is no greater than 26.0% of the second electrode's volume.
4. The electrochemical cell of claim 1, wherein the volume of zinc is no greater than 24.0% of the second electrode's volume
5. The electrochemical cell of claim 1, wherein the second electrode comprises a gelling agent, said gelling agent comprises an absorbed quantity of an aqueous alkaline solution, said solution comprises no more than 36% by weight potassium hydroxide.

6. The electrochemical cell of claim 5, wherein said solution comprises no more than 34% by weight potassium hydroxide.
7. The electrochemical cell of claim 5, wherein said solution comprises no more than 32% by weight potassium hydroxide.
8. The electrochemical cell of claim 5 wherein said second electrode has a resistivity value less than  $4 \text{ m}\Omega\cdot\text{cm}$ .
9. The electrochemical cell of claim 1 wherein said particulate zinc has a BET specific surface area greater than  $400 \text{ cm}^2/\text{g}$ , a KOH absorption value of at least 14%, and a  $D_{50}$  less than 130 microns.
10. The electrochemical cell of claim 1 wherein said tap density is greater than  $2.90 \text{ g/cc}$  and less than  $3.55 \text{ g/cc}$ .
11. The electrochemical cell of claim 1 wherein said tap density is greater than  $3.00 \text{ g/cc}$  and less than  $3.45 \text{ g/cc}$ .
12. The electrochemical cell of claim 9, wherein said BET specific surface area is greater than  $450 \text{ cm}^2/\text{g}$ .
13. The electrochemical cell of claim 9, wherein said KOH absorption value is at least 15%.
14. The electrochemical cell of claim 9 wherein said  $D_{50}$  is between 100 and 130 microns.

15. The electrochemical cell of claim 14, wherein said  $D_{50}$  is between 110 and 120 microns.

16. The electrochemical cell of claim 1 wherein said particulate zinc is a zinc alloy comprising bismuth between 75 ppm and 125 ppm, indium between 175 ppm and 225 ppm, and aluminum between 75 ppm and 125 ppm.

17. A process for manufacturing an electrochemical cell comprising the steps of:

a) providing an open ended container housing a first electrode and a separator, said first electrode defining a cavity lined by said separator;

5        b) mixing zinc powder having a tap density between 2.80 g/cc and 3.65 g/cc with a gelling agent and an alkaline solution to form a gelled mixture having a known volume, wherein said zinc powder in said mixture occupies less than 28.0 volume percent of said mixture's volume, said mixture comprising less than 50 ppm of mercury;

10        c) disposing said mixture into said separator lined cavity; and

d) sealing said container's open end thereby forming an enclosed electrochemical cell.

18. The process of claim 17, wherein said alkaline solution comprises no more than 36 weight percent potassium hydroxide.

19. The process of claim 18, wherein said alkaline solution comprises no more than 34 weight percent potassium hydroxide.

20. The process of claim 19, wherein said alkaline solution comprises no more than 32 weight percent potassium hydroxide.

21. The process of claim 17, wherein said zinc occupies no greater than 27.0 volume percent of said mixture's volume

22. The process of claim 21, wherein said zinc occupies no greater than 26.0 volume percent of said mixture's volume

23. The process of claim 22, wherein said zinc occupies no greater than 24.0 volume percent of said mixture's volume

24. An LR6 size electrochemical cell, comprising:

- a) a cylindrical container housing a first electrode defining a centrally located cavity therein;
- b) a second electrode having less than 50 ppm of mercury and disposed within said cavity, said second electrode comprising no more than 4.3 grams of zinc powder having a tap density between 2.80 g/cc and 3.65 g/cc;
- c) a separator located between said electrodes; and
- d) a quantity of alkaline electrolyte in contact with said electrodes and separator;

wherein said cell, if discharged at 250 milliamps constant current for one hour per day, would have a minimum closed circuit voltage of 0.90 volts for at least 538 total accumulated minutes.

25. The electrochemical cell of claim 24, wherein said cell, if discharged across a 43 ohm resistor for four hours per day, would have a minimum closed circuit voltage of 0.9 volts for at least 100 total accumulated hours..

26. The electrochemical cell of claim 24 wherein said second electrode comprises a gelling agent, said gelling agent comprises an absorbed quantity of an aqueous solution, said solution comprises no more than 36% by weight KOH.
27. The electrochemical cell of claim 26, wherein said second electrode comprises, in addition to said zinc powder, an aqueous solution having no more than 33 weight percent potassium hydroxide, said weight percent of potassium hydroxide based on the total quantities of water and potassium hydroxide in said second electrode just prior to disposing the second electrode into said container.
28. The electrochemical cell of claim 27, wherein said potassium hydroxide in said second electrode's aqueous solution is less than 32 weight percent.
29. The electrochemical cell of claim 28, wherein said potassium hydroxide in said second electrode's aqueous solution is no more than 31 weight percent.
30. An LR6 electrochemical cell, comprising:
- a) a cylindrical container housing a first electrode defining a centrally located cavity therein;
  - b) a second electrode disposed within said cavity, said second electrode comprising no more than 4.3 grams of zinc powder having a tap density between 2.80 g/cc and 3.65 g/cc and less than 50 ppm of mercury;
  - c) a separator located between said electrodes; and

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- d) a quantity of electrolyte in contact with said electrodes and separator;

wherein said cell, if discharged across a 43 ohm resistor for four hours per day, would have a minimum closed circuit voltage of 0.9 volts for at least 100 total accumulated hours.

- 31. The electrochemical cells of claim 30, wherein said cell, if continuously discharged at a rate of one watt, would have a minimum closed circuit voltage of 1.0 volts for at least 58 minutes.

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- 32. The electrochemical cell of claim 30, wherein said second electrode comprises, in addition to said zinc powder, an aqueous solution having no more than 33 weight percent potassium hydroxide, said weight percentage of potassium hydroxide based on the total quantities of water and potassium hydroxide in said second electrode just prior to disposing the second electrode into said container.

- 33. The electrochemical cells of claim 32, wherein said potassium hydroxide in said second electrode's aqueous solution is less than 32 weight percent.

- 34. The electrochemical cells of claim 33, wherein said potassium hydroxide in said second electrode's aqueous solution is no more than 31 weight percent.

- 35. An LR6 electrochemical cell, comprising:

- a) a cylindrical container housing a first electrode defining a centrally located cavity therein;

- 5                   b) a second electrode disposed within said cavity and having less than  
50 ppm of added mercury, said second electrode comprising no  
more than 4.3 grams of zinc powder having a tap density between  
2.80 g/cc and 3.65 g/cc;
- c) a separator located between said electrodes; and
- 10                  d) a quantity of electrolyte in contact with said electrodes and  
separator;

wherein said cell, if continuously discharged at a rate of one watt, would  
have a minimum closed circuit voltage of 1.0 volts for at least 58 minutes.

36. The electrochemical cell of claim 35, wherein said cell, if discharged at  
250 millamps constant current for one hour per day, would have a  
minimum closed circuit voltage of 0.90 volts for at least 538 total  
accumulated minutes.

37. The electrochemical cell of claim 35, wherein said second electrode  
comprises, in addition to said particulate zinc, an aqueous solution having  
no more than 33 weight percent potassium hydroxide, said weight  
percentage of potassium hydroxide based on the total quantities of water  
5                  and potassium hydroxide in said second electrode just prior to disposing  
the second electrode into said container.

38. The electrochemical cell of claim 37, wherein said potassium hydroxide in  
said second electrode's aqueous solution is less than 32 weight percent.

39. The electrochemical cell of claim 38, wherein said potassium hydroxide in  
said second electrode's aqueous solution is no more than 31 weight  
percent.

40. An electrochemical cell, comprising:
- a) a container housing a first electrode, said electrode defining a cavity therein;
  - b) a separator lining said cavity and abutting said first electrode;
  - 5 c) a second electrode comprising zinc powder and disposed within said separator lined cavity, said zinc powder having a tap density greater than 2.80 g/cc and less than 3.65g/cc, a BET surface area greater than 400 cm<sup>2</sup>/g, a KOH absorption value of at least 14%, and a D<sub>50</sub> less than 130 microns; and
  - 10 d) a quantity of alkaline electrolyte disposed within said container and in contact with said electrodes and said separator.
41. The electrochemical cell of claim 40 wherein said tap density is greater than 2.90 g/cc and less than 3.55 g/cc.
42. The electrochemical cell of claim 41 wherein said tap density is greater than 3.0 g/cc and less than 3.45 g/cc.
43. The electrochemical cell of claim 40, wherein said BET specific surface area is greater than 450 cm<sup>2</sup>/g.
44. The electrochemical cell of claim 40, wherein said KOH absorption value is at least 15%.
45. The electrochemical cell of claim 40 wherein said D<sub>50</sub> is between 100 and 130 microns.
46. The electrochemical cell of claim 45, wherein said D<sub>50</sub> is between 110 and 120 microns.



47. The electrochemical cell of claim 40 wherein said zinc powder is a zinc alloy comprising bismuth between 75 ppm and 125 ppm, indium between 175 ppm and 225 ppm, and aluminum between 75 ppm and 125 ppm.